

APPLICATION FOR PATENT

of

MARC TRAYLOR

for

RESILIENT MAGNETIC PAINTBRUSH HOLDER

BACKGROUND OF THE INVENTION

Painters have found that a brush holder of some type is a very useful item. The brush holder avoids the need to lay a wet brush on a surface which may not be clean. Further, the holder keeps the brush from falling into the paint in the paint can, particularly if the brush is relatively small and the can is relatively full. Also, a brush holder serves to maintain the brush in a ready-to-use condition and at a consistent location.

Because of the usefulness of a brush holder, inventors have devised a large number of holders for supporting a paintbrush in a paint can. In one type of paintbrush holder, the holder includes a clamp that grasps the handle of the paintbrush. In another type of holder, a magnet is used to hold the paintbrush by magnetic attraction between the magnet and the ferrule of the paintbrush. The present invention is an improvement on the magnetic type of paintbrush holder.

In a typical magnetic paintbrush holder of the prior art, the magnet included a pole face that is located in a vertical plane or an inclined plane. The ferrule of the brush is drawn against the pole face by magnetic attraction, and this force is in a direction

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1 connection with the accompanying drawings in which several preferred embodiments of the  
2 invention are illustrated by way of example. It is to be expressly understood, however, that  
3 the drawings are for the purpose of illustration and description only and are not intended as  
4 a definition of the limits of the invention.

### 5 6 7 BRIEF DESCRIPTION OF THE DRAWINGS

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9 Fig. 1 is an exploded perspective view showing a first preferred embodiment  
10 of the resilient magnetic paintbrush holder of the present invention;

11 Fig. 2 is an exploded perspective view showing a second preferred  
12 embodiment of the present invention;

13 Fig. 3 is a diagram used for explaining the invention; and,

14 Fig. 4 is a diagram used for explaining the invention.  
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### 16 17 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

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19 Fig. 1 shows a first preferred embodiment of the present invention. In that  
20 embodiment, a spring 2 connects the clamp 6 with a magnet 1. In this embodiment, caps 3  
21 are secured to both ends of the spring 2. One of the caps is bonded to the magnet 1 by the  
22 use of an epoxy adhesive, and the other cap is bonded to the channel 4 portion of the  
23 clamp 6. The clamp includes a thumb screw 5 that is used for securing the clamp to the rim  
24 of an open paint can.

25 Fig. 2 is an exploded perspective view showing a second preferred  
26 embodiment of the invention. In this embodiment, the clamp 6 (except for the thumb  
27 screw 5) the resilient member 7, and the magnet holder 8 are fabricated by a molding process  
28 and constitute a one-piece structure. The magnet 1 is bonded into the magnet holder 8, and  
29 the thumb screw 5 is added. The clamp 6 fits over the rim of the paint can and is secured in  
30 place by tightening the thumb screw 5.

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In both embodiments, the thumb screw clamp 6 may be replaced by a resilient clamp without departing from the spirit of the invention.

Figs. 3 and 4 are diagrams used for explaining the invention. In Fig. 3, the pole face of the magnet 1 is shown as being inclined at an angle  $\theta$  with respect to the horizontal. The magnetic attraction force is denoted by  $F$ , and is perpendicular to the pole face. The weight  $W$  of the paintbrush is vertically downward and its component parallel to the pole face is  $W \sin \theta$ . The frictional force always opposes motion and its magnitude is  $\mu F$  where  $\mu$  is the static coefficient of friction.

In order for the paintbrush not to slide down the pole face, it is necessary for the frictional force  $\mu F$  to be greater than the downward component of the weight, namely  $W \sin \theta$ . If the pole face is vertical,  $\sin \theta$  equals 1.0 and the weight of the paintbrush must be less than  $\mu F$ .

The coefficient of static friction depends on the specific materials involved; for metals it might be on the order of 0.2. This would imply that a magnetic attraction force of 5 pounds would result in a frictional force of only 1 pound.

Turning now to Fig. 4, the paintbrush 9 and magnet 1 located at the end of the resilient portion 7 will vibrate up and down as indicated by the arrows, when set into motion. One way to set the brush into vibratory motion is for the user to set the paint can down abruptly onto a hard surface.

Thus, it is recognized that the system comprised of the paintbrush and resilient portion constitutes a classical physics situation of a mass mounted on a spring; such systems have been thoroughly studied. The time required for one complete cycle of the vibration is

$$T = 2\pi \sqrt{\frac{M}{K}}$$

where

$T$  is the time in seconds for one complete cycle of vibration,

$\pi$  is 3.1416

$M$  is the mass in pound second squared per foot, found by dividing the weight  $W$  of the magnet and paintbrush in pounds by the gravitational

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1 acceleration of 32 feet per second squared,  
 2 and K is the force constant of the resilient member in pounds per foot,  
 3 determined experimentally by observing the deflection that results when  
 4 the resilient member is loaded with a known weight.

5 For example, if the paintbrush weighs 0.5 pound and it requires 3 pounds to produce a  
 6 deflection of one inch, then the time required for one complete cycle of the vibration is  
 7 0.1307 seconds; the frequency of the vibration is 7.65 cycles per second.

8 The maximum displacement of the brush occurs at the end of the first quarter  
 9 cycle after the paint can is set down. In the example, that is 0.0327 seconds after the can is  
 10 set down. At that time, the instantaneous velocity is zero; but because the elastic restoring  
 11 force is greatest, the acceleration is also greatest. The acceleration at maximum displacement  
 12 can be calculated by the equation

$$a = \frac{K}{M} D$$

15 where a is the maximum acceleration and D is the maximum displacement. That is, the  
 16 acceleration depends on how hard the paint can was set down. To find the maximum  
 17 deflection, consider that the paintbrush continues <sup>its</sup> downward motion against the restoring  
 18 force of the resilient member until all of the initial kinetic energy of the brush and magnet  
 19  $\frac{1}{2} M V_0^2$  has been converted into potential energy stored in the resilient member, where  $V_0$   
 20 is the velocity of the paintbrush as the paint bucket is being set down. This potential energy  
 21 (P.E.) may be calculated by the equation

$$P.E. = \frac{1}{2} K D^2$$

24 Equating the initial kinetic energy to the potential energy at the maximum displacement gives  
 25 the equation

$$\frac{1}{2} M V_0^2 = \frac{1}{2} K D^2$$

28 from which D can be calculated as

$$D = V_0 \sqrt{\frac{M}{K}}$$

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If  $V_0$  is 0.5 ft. per second, the maximum displacement is 0.1248 inch, and the acceleration is found to be 24 ft/sec<sup>2</sup>, which equals 0.75" g".

If the paintbrush weighs 0.5 pound and is subjected to an additional 0.75" g", the maximum downward force of the paintbrush is 0.875 pound.

If the force of magnetic attraction is 5.0 pound and the coefficient of static friction is 0.2, the frictional force is 1.0 pound and the brush should not slide off the magnet.

The advantage of the present invention can best be seen by combining the equation given above for the maximum acceleration  $a$  with the equation for the maximum displacement  $D$ , giving

$$a = \frac{K}{M} D = \frac{K}{M} V_0 \sqrt{\frac{M}{K}} = V_0 \sqrt{\frac{K}{M}}$$

From this equation it is seen that, assuming the mass  $M$  and the velocity of the brush to be constant, the maximum acceleration of the brush is proportional to the square root of  $K$ . The stiffer the resilient member is, the greater the maximum acceleration. In the above example it was assumed that the spring had a force constant  $K$  equal to 3 pound per inch (equals 36 lb./ft.).

By way of contrast, if the spring were replaced by a rigid bracket such as those used in the prior art, the force constant  $K$  could be 3 lb. per hundredth of an inch (equals 3600 lb./ft.). It is seen that, in this example, the use of the spring instead of a rigid bracket reduces the maximum acceleration of the brush by a factor of 10, from 7.5" g" to 0.75" g", and the maximum downward force of the paintbrush is reduced from 4.25 pounds to 0.875 pound. This reduction clearly makes the difference between the paintbrush remaining on the magnet and <sup>its</sup> being jarred off the magnet and falling into the paint.

Thus, there has been described a magnetic paintbrush holder that incorporates a resilient member to reduce the mechanical shocks felt by the brush.

The foregoing detailed description is illustrative of several embodiments of the invention, and it is to be understood that additional embodiments thereof will be obvious to those skilled in the art. The embodiments described herein together with those additional embodiments are considered to be within the scope of the invention.

What is claimed is:

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